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Title: Company employees as experimental participants in traffic safety research: prevalence and implications

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Conflict of interest declaration

The first author is on the editorial board of Transportation Research Part F: Traffic Psychology and Behaviour and knows personally all of its three editors who were invited to respond to our survey. He is also on the editorial board of IATSS Research. Whether this fact had any effect on the editors' decision to respond or not, and in what way (good or bad subjects?) is unknown.

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Abstract

The use of company employees as experimental participants when testing products, technology or paradigms developed by the same company raises questions about bias in results and research ethics. We aimed to investigate the prevalence of studies authored by car company researchers with car company employees as participants, to assess the risk of bias in such studies, to investigate journal editors' opinions in the field of traffic safety regarding these procedures, and to offer a general discussion about ethical and methodological implications. Three types of data were collected. We (i) examined guidelines and recommendations for authors in eleven selected peer-reviewed journals in the area of traffic safety; (ii) surveyed editors of these journals; and (iii) reviewed articles authored by researchers from a selected group of car manufacturers and published in these journals during 2011-2015. Guidelines and recommendations for authors in the included journals did not mention whether and under what circumstances company employees can be research participants, nor did publishers' general guidelines. However, three out of the four editors who responded to our survey believed that this issue of private company researchers using participants from the same company deserves to be explicitly addressed in their journal's guide for authors. The total number of regular articles and conference papers during 2011-2015 in the eleven journals reviewed was 6763; 95 (1.4%) listed at least one car manufacturer in the authors' affiliations; and out of these, nine included company employees as participants. In summary, company employees are seldom (0.13%) used as research participants in traffic safety research. Nevertheless, the use of company employees as research participants raises questions about bias in results as well as about incursions into the participants' autonomy.

Keywords: Public-private partnership; experimenter effect; good subject effect; publication bias

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1. Introduction

Imagine this situation: researchers from a pharmaceutical company publish results of a clinical trial funded by the company; the trial was not preregistered; company employees served as participants and were not paid for their participation as testing took place during regular working hours; experimenters were company employees and not blinded to the allocation of participants to different groups; and the paper concludes that the company's new drug was effective against a certain disease. We think it is unlikely that such a study would appear today, and if it did, we think it would be met with considerable skepticism from journal editors and readers. It is even less likely that the drug would obtain regulatory approval based on such a study. Now replace the pharmaceutical company with a car manufacturer and the new drug with new in-vehicle technology (e.g., advanced driver assistance systems–ADAS) that is supposed to improve traffic safety. Things now look much different. Not only could such a paper be published, the results would likely be interpreted as support for the new ADAS, which in the end could be implemented in millions of new vehicles. One could argue that there is a difference between drugs and in-vehicle technologies in terms of legislation and possible damage to the end users, but in both cases we would question the validity of the results and suspect at least a certain degree of consumer deception.

Problematic issues in the above example are apparent, such as possible conflicts of interest and the high risk of experimenter effects, i.e. communication of subtle cues to the participant causing results to shift in the direction desired by the experimenter. With advancements of in-vehicle technology in recent years, there has been an increase in naturalistic and driving simulator experiments. As previously noted (Radun, Kaistinen & Lajunen, 2015), due to the high costs associated with this type of research and the obvious interest of car manufacturers in the testing and further development of their in-vehicle technologies, car companies are typically involved in carrying out such studies. However, to our knowledge, little is known about the extent of studies

authored by car company researchers, especially those that utilized company employees as participants.

Therefore, this study aimed (i) to investigate the prevalence of studies authored by car company researchers with car company employees as participants and (ii) to discuss the ethical and methodological issues which might arise in such situations. We based our discussion on three types of data collected from a selected number of peer-reviewed journals in the area of traffic safety: examination of their guidelines and recommendations for authors; survey of editors of these journals; and a review of articles authored by researchers from a selected group of car manufacturers.

2. Materials and methods

Three types of data were collected. First, we (IR & GN) examined guidelines and recommendations for authors in eleven major traffic safety peer-reviewed journals (see the list below) for statements regarding the use of company employees as participants. These journals were selected by the first author and were based on his knowledge of the field. We aimed to cover as comprehensively as possible all specialized peer-reviewed journals that include evaluations of in-vehicle traffic safety technology within their scope. One relevant journal (*Transportation Research Record*) was not included, as the first author did not have institutional access to articles in this journal.

Secondly, we invited the editors-in-chief of these journals to answer a short online survey regarding the scientific and ethical aspects of studies performed by companies that use their own employees as experimental participants. The editors were presented with one opening sentence ("Consider the following situation: A researcher working for a car manufacturer uses employees from the same company in their behavioral experiments regarding in-vehicle technologies") and asked several

questions (see Table 1). We were unable to find the email address of one editor (*Journal of Safety Research*); thus the invitation was sent to 12 editors from 10 journals (*Transportation Research Part F: Traffic Psychology and Behaviour* has three co-editors). The first author sent personalized invitations in May 2015, the first reminder in June, and the final reminder in the autumn of the same year.

Thirdly, we reviewed articles published in these journals during 2011–2015, which were authored by at least one researcher from car manufacturers. Only regular articles and conference proceedings were included. The list of car manufacturers was taken from Wikipedia (see appendix). The search was performed in Scopus database; a full syntax including the list of car manufacturers can be found in the appendix.

Journal list: *Accident Analysis & Prevention* (AAP), *Ergonomics* (ERG), *Human Factors: The Journal of the Human Factors and Ergonomics Society* (HF), *IATSS Research* (IR), *IET Intelligent Transport Systems* (IET), *Injury Prevention* (IP), *Journal of Safety Research* (JSR), *Traffic Injury Prevention* (TIP), *Transportation Research Part C: Emerging Technologies* (TRC), *Transportation Research Part F: Traffic Psychology and Behaviour* (TRF), and *Safety Science* (SS). The publishers of these journals are given in the appendix.

3. Results

We have found no specific information regarding the issue of company researchers using company employees as study participants in guidelines and recommendations for authors in these eleven major traffic safety peer-reviewed journals. Typically, the ethical issues are addressed in the publisher's general guidelines, such as Elsevier's Publishing & Research Ethics (https://www.publishingcampus.elsevier.com/pages/63//ethics/Publishing-ethics.html) and Taylor &

Francis's Ethics for authors (http://authorservices.taylorandfrancis.com/ethics-for-authors/). We have not found there any explicit information regarding the issue in question. Furthermore, all publishers also provide links to other ethical guidelines, such as the American Psychological Association's (APA) Ethical Principles of Psychologists and Code of Conduct, and the Committee of Publications Ethics (COPE) website. In the discussion we will refer repeatedly to the APA guideline.

Four out of twelve editors responded to our invitation. Their answers and comments are presented in Table 1.

The total number of regular articles and conference papers during 2011–2015 in the eleven journals was 6763. Based on our search criteria we identified 102 publications; however, after close checking (IR) six articles were excluded as it became clear that the authors of these studies were not affiliated with any car manufacturer (one author's affiliation included the Edward *Ford* Building, four papers were published by an author from the Henry *Ford* Health System, and one author was working for *Tata* Steel). One additional paper was excluded as it was incorrectly indexed as a regular article although it was a review. Therefore, from the total number of 6763 articles, 95 (1.4%) were included in the following analysis.

These papers were independently read by two authors (IR and JR), and after discussion, were categorized as follows:

1. No human participants (accident databases, simulations, dummy testing, etc.; N=31)

2. Human participants, but not a behavioral study relevant to traffic safety (e.g., collecting anthropometric dimensions for truck drivers; 3D analysis of the driver's joint torques developed during entering/leaving a vehicle; N=7)

3. Information about recruitment, participants were not employed in the same company as researchers (N=21)

4. No information or unclear information about participant recruitment (N=21)

5. Participants were car company employees (N=9)

6. Participants were university employees and/or students (N=6; one of these studies also utilized other than student participants)

One of the nine papers which were authored by at least one researcher from a car manufacturer and that included the car manufacturer's employees as participants was excluded from the detailed analysis as it was not relevant to traffic safety. The study examined "push force and its perception during a flexible hose insertion task encountered in a truck assembly line" (Wang et al., 2014).

Regarding the articles which contained no information about recruitment of participants, we considered contacting the authors for clarification. However, after the first three emails were distributed, the process was stopped since we realized that the whole process would be very time-consuming and, most importantly, we felt it might be perceived as a questioning of their research integrity. Nevertheless, after the author's response, one article (number 2 in Table 2) was re-classified as having company employees. Therefore, nine articles were independently reviewed by two authors (IR and GN), and after discussion, a conclusion was reached as presented in Table 2.

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Table 1. Editors' answers

Questions	1. In such a situation, do you think that there is an increased risk that good subject effect and experimenter effect could generate invalid data? (Good subject effect occurs when subjects comply with what they believe is expected of them. The experimenter effect occurs when an experimenter unintentionally communicates his/her expectations to the subjects and influences their performance or responses.)	Comment	2. In such a situation, would you anticipate any general or specific ethical issues?	Comment	3. Have you come across such studies?	Comment	4. Do you think that this issue of private company researchers using participants from the same company deserves to be explicitly addressed in your journal's guide for authors?	Comment	5. Please provide any additional comments you might have.	6. If you are happy for us to quote any of your written comments and attribute them to you, please write your name here.
Editor 1	No, I don't think so [in most cases the risk of getting invalid data is not high]	I have done many such studies without concern. We do not involve anyone with knowledge or affiliation with the research to avoid conflicts of interest.	No		Yes, many times		Yes	All samples should be described, consent forms overviewed, and any exclusion criteria described.		
Editor 2	Yes, I think so [in principle there is an increased risk, but it highly depends on the type of a study]	Depends on what was studied and how. Risk is low if the participants do not know what is expected or the behavior studied is very physiological (e.g. gaze directions)	Yes	Isn't it obvious?	I cannot remember having come across any	We get only a few studies from industry and they are mainly very basic physiological measurements.	No	We can deal with it in the review process		
Editor 3	Yes, I think so [in principle there is an increased risk, but it highly depends on the type of study]		Yes	Depending on the design and whether data can be collected anonymously there could be perceived risks to employees concerning how their behavior impacts job evaluations.	I cannot remember having come across any		Yes			
Editor 4	Yes, I think so [in principle there is an increased risk, but it highly depends on the type of study]		Yes		I cannot remember having come across any		Yes	Probably yes		

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Table 2. Review of nine papers

Study	Study summary	Participants information	Participants' consent, ethical issues and reimbursement	Comments
1. Hajek et al., 2013	A driving simulator study. Regular active cruise control (ACC) and workload-adaptive cruise control (WACC) were compared in a within-group design. The main outcomes were the feasibility of detecting a high workload state using physiological recordings, brake reaction time and deceleration rate, and participants' acceptability of the system.	"All participants were BMW employees, who took part in the experiment without receiving any compensation." "…and 50% of participants had experience in a driving simulator." (p.110)	The participants were not paid for their participation. They "were told that they could stop the experiment at any time if they experienced" simulator sickness (p.112).	Given that the study was carried out by company researchers at the company facilities, that the company employees served as participants, and 18 of 65 participants were excluded due to "technical problems" (p. 110), the conclusion that "WACC systems should be considered as a next step in the development of ADAS [Advanced Driver Assistance Systems]" (abstract, p. 108) is based on results with a high risk of bias. We have serious concerns about recruitment procedure and the level of voluntarism from the low-power group, which company employees certainly represent.
2. Hildebrandt et al., 2015	An instrumented car experiment on a closed test track. The objective was "to develop and verify a driver assistance function" for critical understeer situations, both "reinforcing the driver's awareness of the driving conditions and giving support to handle the situation correctly, without inducing irritation by abnormal steering behavior." In a car on a test track, subjects performed two different maneuvers with and without the understeer assistance activated.	In the abstract (p. 484): "Not only objective measurement data but also subjective ratings delivered by 63 unbiased participants were used." Concerning funding (p. 490): "This research was supported by BMW AG, Munich. The authors acknowledge the support of the involved employees while carrying out trials at the BMW test area Messgelände Aschheim."	No information was provided except "The use of anonymous data from human subjects was approved by the individual participants" (Funding, p. 490).	Given the acknowledgment to "the involved employees" in the Funding section (p.490), we contacted the first author who confirmed that the participants were recruited from a subject pool consisting of BMW employees and close business partner employees. Since the study was carried out by company researchers at company facilities, company employees served as participants, and new in-vehicle technology was tested, the conclusion "By measuring vehicle data and eliciting subjective opinions of the participants, the effectiveness regarding an improved handling of an understeering vehicle as well as the acceptance of the understeer assistance by the driver is confirmed" (p. 484) is based on results with a high risk of bias. Given that the authors failed to mention that the participants had been recruited among company employees, we express serious concerns about the methodological and ethical approach in this study.
3. Koustanai et al., 2012	A driving simulator study. It "addressed the role of familiarization on a driving simulator with a forward collision warning (FCW) and investigated its impact on driver behavior." Three different types of familiarization were: reading the system manual; manual reading and active familiarization in the simulator; no familiarization.	In the Method section (p.711): "The participants, recruited among the Renault technical staff…They had no prior experience in using FCWs."	No information was provided	Given that the training (familiarization) with the system was the main independent variable in the study and that the participants ("Renault technical staff") probably came from the same working place, it is unclear (to us) whether communication between participants who completed the testing and those waiting their turn was possible or not. Again, the concluding sentence in the abstract (p.709) "Familiarization on the simulator had a positive effect on driver-system interactions and on trust in the system" seems to be based on results with a high risk of bias. The lack of information about recruitment and reimbursement

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				procedures and consent raises ethical questions.
4. Larsson & Niemand,2015	A driving simulator study. The aim was to test whether adding sounds (spearcons-time compressed speech sounds or earcons-musical sounds vs. baseline-no sound) to an in-vehicle user interface reduces "glances toward a visual display when browsing menus." There were 6 different tasks, making it 3x6 within-group factorial design.	"Fourteen persons (2 female) between 32 and 59 years old recruited from within the company took part in the experiment" … "All participants held truck driver's licenses and were required to be native Swedish speakers (due to the use of Swedish menus and spearcons)" (p.27).	No information was provided except, "Participants were then debriefed and thanked for their participation" (Procedure, p.27)	The lack of information about recruitment procedure, reimbursement and consent raises ethical questions. As no detailed information was provided about the instruction given to the participants about the purpose of the study, it is difficult to estimate whether the experimenters could have produced an expectation bias.
5. Platten et al., 2013	A driving simulator study. The study investigated behavior adaptations when using an infotainment system. The primary hypothesis was that drivers would decrease their interactions with the infotainment system when anticipating a hazardous situation. The secondary hypothesis was that a cue for the development of the traffic situation would cause a greater reduction in interaction with the infotainment system and less hasty braking when critical situations occurred. The setting was a driving simulator.	"38 participants took part in this study, eight of them were female. […] Most of them were BMW Group employees from different departments, and none were paid for their participation." (p.105)	No information except that participants were not paid.	If most of the participants were BMW employees, it is unclear (to us) who the rest were, how they were recruited and why they were not paid for their participation. The lack of information about recruitment procedures and consent raises ethical questions. The study did not directly test any specific in-vehicle technology.
6. Platten et al., 2014	A driving simulator study. The study examined whether the interruptibility (perceived loss of performance vs. no loss) of the secondary task influences actual interruption of the task and perception of the associated workload in situations with different anticipations of the further driving situations.	"33 participants took part in this simulator study, 11 of them were female. […] Most of them were BMW Group employees from different departments, and none were paid for their participation." (p.41)	No information except that the participants were not paid for their participation.	There was no mention of debriefing although "As a cover story, the participants were instructed that the vehicle has two Advanced Driver Assistance Systems" (p.42). The lack of information about recruitment procedures and consent raises ethical questions.
7. Sonnleitner et al., 2015	An instrumented car experiment on a closed test track. Testing the effects of a secondary auditory task on EEG alpha spindles and driving performance (time reaction) in a car-following task with forced braking.	"The sample consisted of 20 participants (22–53 years, mean: 29.0 years, five females). Subjects were recruited from an in-house database in which volunteers for experiments are listed." … "Participation was voluntary and occurred during working hours." (p. 111)	"All experimental procedures were conducted in accordance with the ethical guidelines of the Declaration of Helsinki. […] Data were collected anonymously. Informed consent was obtained after the task had been explained. Participants were informed they had the option to end participation in the experiment at any time without any type of penalty. Participants received a gift worth approximately 20€ for their participation." (p.111)	The participants' consent, ethical issues and reimbursement were addressed. The study did not directly test any specific in-vehicle technology.
8. Tivesten & Dozza, 2014	Naturalistic driving study EuroFOT. Data collected in Sweden. "The objective of this study is to	"This study analyzed data collected in the EuroFOT project,	A reference was given to Sanchez et al. 2012.	It is clear from (some) EuroFOT reports that the drivers in the Swedish sample were Volvo employees and their family members.

	investigate how different driving contexts and visual-manual phone tasks influence drivers' glance behavior in naturalistic driving."	which included naturalistic data from 100 Volvo cars driven in real traffic for one year. [...] In total, approximately 1.0 million km were recorded and stored in the database, comprising 198 drivers (M = 45.3 years, SD = 10.8 years, 57% male, 43% female)." (p.260) No other information about sample selection in Sweden, only referral to one of EuroFOT reports (Sanchez et al. 2012).	However, we failed to find clear information about how the participants were recruited.	For example, in one of the presentations at the final EuroFOT event it says about the participants in the Swedish sample, "Volvo employees and their family members in Sweden" (Csepinszky, 2012). This is not explicitly mentioned in the paper. Only in the discussion (p. 269) do the authors write: "In this study the participant sample was biased, as the primary drivers were mainly males, 35–65 years of age. However, the fact that other members of the household also drove the cars made the driving data somewhat more representative of the driving population. In addition, all the data was collected in one Scandinavian city."
9. Tivesten & Dozza 2015	Naturalistic driving study EuroFOT. Data collected in Sweden. "This study investigated how the driving context influences drivers' decisions to engage in visual–manual phone tasks in naturalistic driving." (p.87)	"This study analyzed naturalistic driving data collected from 100 Volvo cars for one year as part of the EuroFOT project. The cars were driven in real traffic by the primary drivers and other members of the household. The drivers all resided in the Gothenburg region of Sweden." (p.88) "All the primary drivers shared the same employer and working location, which made it easy to identify many of the commuting trips." (p.89)	Same as Tivesten & Dozza, 2014.	Same as Tivesten & Dozza, 2014.

4. Discussion

We found no mention of whether and under what circumstances company researchers can use company employees as participants in guidelines and recommendations for authors in the eleven major traffic safety peer-reviewed journals as well as in publishers' general guidelines. After two reminders, only 4 out of 12 contacted editors responded to our survey. The low response rate and small absolute number of responses limit interpretation. Possibly, non-responding editors did not consider the issue to be important. However, three out of the four editors who responded indicated that the issue of private company researchers using participants from the same company deserves to be explicitly addressed in their journal's guide for authors. One of the editors wrote in his/her comment to this question that "We can deal with it in the review process." Judging from the answers from the four editors, such submissions do not happen often, as 3 out of 4 editors said that they cannot remember having come across any.

It might well be that such studies are not common. Our analysis shows that only 1.4% of regular articles and conference proceedings published in these eleven journals stated that they had at least one researcher working for the selected car manufacturers. Furthermore, only nine of these 95 publications could be classified as having certainly utilized company employees as participants, yielding an overall proportion of only 0.13%. However, the lack of information about participant recruitment in many cases (N=21) precludes assessment of whether company employees were used as experimental participants, which means that the proportion could be considerably higher with an upper limit of 0.44% if all of these 21 studies used company employees.

In the following sections, we offer a more general discussion about ethical and methodological issues that, in our view, might arise in situations when company employees are used in company conducted research. Although some would argue that we have not provided any or too little

empirical data to support such concerns, we believe our discussion is important and timely given the enormous investments in the development of semi and fully autonomous vehicles by the industry.

4.1. Publication bias

The tendency of researchers to submit mainly studies with statistically significant results, and the fact that such studies are more likely to pass the peer review and get published, results in publication bias (Ioannidis et al., 2014). Some researchers argue that "most published research findings are false" (Ioannidis, 2005) or "…much of the scientific literature, perhaps half, may simply be untrue" (Horton, 2015, p.1380). The Open Science Collaboration attempted to replicate 100 studies in experimental psychology, and found that the replication effect size was on average about half of the originally reported effect size (Open Science Collaboration, 2015).

In pharmaceutical research, it has been found that studies funded by pharmaceutical companies are less likely to be published if the results do not support the efficacy of the drug, compared to trials not funded by companies (Ross et al., 2009). We suspect that the same relationship may hold in studies of new in-vehicle technology, which has an obvious potential market value.

However, none of the nine articles that utilized company employees as participants has been conducted solely by car company researchers. In eight cases, at least one author was affiliated with a university, and in one case (study 3) three authors were affiliated with an institute under ministry supervision. Such research collaboration between universities, business, and government is becoming standard in the modern world (Nyman, 2015).

Although the benefits of the collaboration are obvious in terms of different expertise and joint funding, there are still potential downsides. For example, there is "the risk of political maneuvers

aiming at guiding university research towards politically favorable problems at the expense of basic research quality and self-direction" (Nyman, 2015, p.19). Furthermore, there is the potential lack of interest of business in conducting and supporting research that will not result in patents or commercial applications. When it comes to road traffic safety, for example, strong concerns were recently raised about Global Road Safety Partnership (GRSP), a public-private partnership that has a significant role in United Nations (UN) and WHO road safety activities (Davies & Roberts, 2014).

On the other hand, such collaboration should probably ensure that high ethical and methodological standards are met as they are, or should be, central to the university researchers' expertise. That would also include protection against putting in a drawer the results of studies that are not favorable to car company interests. However, the first author's anecdotal evidence indicates that university researchers can be under significant pressure from private companies (and state organizations) not to publish results that are not in their interest even if non-disclosure agreements are not signed. Only the policy of pre-registering studies, which has become more common in pharmacological research, can protect against such publication bias. Whether this will also become common in other areas of research, especially for studies with potential commercial applications, is yet to be seen.

4.2. Ethical issues regarding the company-experimenter-participant relationship

Company researchers obviously have some responsibility and loyalty to their company. How far this can go and whether it represents a threat to researcher integrity is difficult to estimate. Perhaps non-disclosure agreements are regularly signed within companies and with outside partners, typically university researchers. However, it is difficult for an outsider to know whether these agreements are signed and what they cover if they are not reported. In particular, it is difficult to know how many studies have never been publically reported because of non-disclosure agreements. On the other hand, company employees serving as participants also have a conflict of interest as

they have relationships (financial, company loyalty, possibly shares, etc.) with those conducting a study that go far beyond the normal participant-experimenter relationship.

Other important ethical questions concern whether employees' participation in such studies is completely voluntary and whether they receive any reimbursement. The American Psychological Association (APA) in its Ethical Principles of Psychologists and Code of Conduct states that "Psychologists do not exploit persons over whom they have supervisory, evaluative, or other authority such as clients/patients, students, supervisees, research participants, and employees" (3.08 Exploitative Relationships). Furthermore, researchers have an "obligation to respect the individual's freedom to decline to participate in or withdraw from any stage of the research process" (Kimmel, 2007, p.214).

In general, we were negatively surprised by the lack of attention given to ethical issues in the reviewed papers, as they were sufficiently addressed in only one of the nine studies (study 7, see Table 1). Regarding reimbursement, no information was provided in five cases (studies 2-4, 8 & 9), participants were not paid in three of the four remaining studies (1, 5 & 6), and in only one study did participants receive monetary reimbursement (a gift worth 20€, study 7). However, in that study, the testing was performed during normal working hours and lasted for several hours. Participating in a research study during normal working hours can even be more problematic if employees are not exempted from their work duties, not only in terms of working hours but also in terms of the actual work that should be performed during that time. Information on how this was handled was not provided in the discussed article. Nevertheless, the employees in study 7 were recruited from an in-house database, which might indicate a certain awareness of procedures and voluntary participation. Regarding the other eight studies detailed information about recruitment was missing. It therefore remains unclear whether participation was voluntary. Nevertheless, it is

reasonable to ask what is the actual level of voluntarism from the low-power group (Kimmel, 2007), which company employees certainly are, even if they come from different departments in the company (e.g., study 6).

4.3. Sample selection bias

The generalizability of results is closely connected with sampling. Drawing a representative sample from a given population allows the results of a study on the sample to be generalized back to the population. Regarding psychology research it has been repeatedly shown that there is a considerable mismatch between desired and declared generalizability, partly since the large majority of psychology studies published in English have been carried out on participants from western developed countries. This figure is as high as 95% for studies published in six major APA journals (Arnett, 2008). Henrich, Heine, and Norenzayan (2010) named such participants as those coming from WEIRD (Western, Educated, Industrialized, Rich, and Democratic) countries. Furthermore, not only did such participants come from WEIRD countries, they are quite often undergraduate students (Korn & Bram, 1987; Sears, 1986), and typically participate in psychology courses or programs (Arnett 2008; Sears, 1986).

It is very questionable whether undergraduate psychology students from WEIRD countries are representative of any other than their own population (Arnett 2008). However, it is clear that they are widely used for obvious practical reasons. Similarly, employees of a car manufacturer represent a convenient sample for company researchers and developers. However, although, for example, middle-aged male engineers can certainly provide valuable feedback regarding the usability of a certain in-vehicle system, they hardly represent an average car user.

4.4.Transparency of scientific reporting

How and from which population participants are recruited is a basic requirement for scientific reporting (APA, 2010). In six of these nine studies, clear information was provided stating that participants were company employees. In one case (study 2), we found out from the corresponding author that their participants were recruited from a subject pool consisting of car company employees and close business partner employees. In two other studies using Swedish EuroFOT data, there was no clear information about participants, only referral to a previously published report (Sanchez et al. 2012). However, even in that study we failed to find explicit information about recruitment procedure. Only in some other EuroFOT reports did we find that participants had been "Volvo employees and their family members in Sweden" (Csepinszky, 2012).

For the Swedish EuroFOT data, we were able to find information on the internet. For some other studies that was not possible. For example, one study (Zeeb, Buchner, & Schrauf, 2015), which we classified as "No information or unclear information about participant recruitment (N=21)" reports that "the participants were recruited using a Daimler AG database of volunteers" (p. 214) and "represent a subset of the data collected within an extended experimental design with 247 participants in total (Cardenas, 2013)." As it was unclear whether company employees might be among the volunteers, as proved to be case with study 2, we wanted to check the Cardenas (2013) publication for more information. Unfortunately, that publication is "an unpublished master's thesis." Referral to previous studies about participants' information is justified in many situations, but the authors bear the responsibility for providing clear references to an available source.

From the original sample of 95 articles authored by at least one researcher from the car manufacturers, we classified 21 as "No information or unclear information about participant recruitment." Furthermore, in 8 of the 9 studies the recruitment procedure of company employees has not been sufficiently described. If we exclude studies with "No human participants (N=31)" and

those with "Human participants, but not really a behavioral study (N=7)," we can see that at least in half of the studies (29/57) there is a lack of information about recruitment procedure. We do not know whether this proportion is typical for other articles published in these journals as we only examined articles authored by at least one car company researcher.

4.5. Experimenter effect

It has been repeatedly shown that informed (and/or biased) experimenters might unintentionally (e.g., using nonverbal cues) transfer their expectations to experimental participants and influence the outcome of the experiment (Gilder & Heerey, 2018; Miller & Turnbull, 1986; Rosenthal, 1966). In order to reduce the probability of the experimenter effect occurrence, the double-blind method has been developed. This procedure can also reduce the observer bias which occurs when the observer's expectations can influence how the participant's behavior is seen and interpreted. However, as has been recently pointed out, the double-blind method "is not often used in the field of traffic research, especially when it comes to keeping the experimenter in the dark about the purpose of the study" (Ahlstrom, 2013). This also applies to life sciences where "non-blind studies tend to report higher effect sizes and more significant p-values" (Holman et al., 2015, p.1).

4.6. Good subject effect

The good subject effect occurs when subjects comply with what they believe is expected of them. As Orne (1962, p.779) writes, "The demand characteristics of the situation help define the role of 'good experimental subject,' and the responses of the subject are a function of the role that is created." This process is largely sub-conscious. It can occur for several reasons, such as a desire to comply with an authority, a general attitude of participating in something worthy, a sense of altruism and a desire to give the researchers what they want. It seems plausible to argue that the probability of this effect occurring would be higher if both experimenter and participants come from

the same company. This effect can be exacerbated when experimenters are informed and not "blinded." In this case, the good subject effect can be considered part of the experimenter effect. (Incidentally, the good-subject effect should not be confused with social desirability bias, another social psychology phenomenon, although they do overlap depending on the type of task and setting.)

4.7. Participants' communication

One of the interesting aspects of recruiting people from the same working place relates to the possibility of participants discussing the experiment together. Research participants should "honor the researcher's request that they not discuss the study with anyone else who might be a participant" (Korn, 1988, p.77). Failing to ensure that can pose a serious risk to the validity of collected data (Kimmel, 2007). This can especially be problematic in studies where one of the independent variables is the type of instruction given to the participants. For example, in the Koustanai et al. (2012) study, training (familiarization) with the system was the main independent variable and pre-informed participants (especially those in the control group) might have, therefore, behaved in different, possibly *good-subject* way. Whether the authors of this study paid attention to this problem is unclear due to lack of information in their article. On the other hand, preventing participant-to-participant discussion about experiments in the Swedish EuroFOT studies (8 &9) was probably very difficult since not only car company employees participated but also their family members.

4.8. Limitations of the study

Response rate for the invited editors to our survey was only 4/12; however, the response rate is similar to those obtained in studies on general driving populations. Whether the reasons for responding or non-responding are the same is impossible to say. Given the lack of clear information

about participant recruitment in 21 out of 95 studies, it is possible that we underestimated the proportion of studies that used company employees as participants. Even with an upper limit of 0.44%, their number could be regarded as small. However, we covered only five years for eleven peer-reviewed traffic safety journals, while the majority of such studies might be presented in various conferences and published as conference proceedings and in the "grey literature." On the other hand, it is likely that research conducted within companies largely remains unpublished as it is used only for internal development and because of competition concerns. However, it is unclear who would be responsible for ensuring that, for example, a driver fatigue detector indeed does what is supposed to do before it gets installed in millions of vehicles.

5. Final remarks

We think that clear information about participant recruitment should always be provided in reports of studies on human participants in the area of traffic safety, as in any other scientific discipline. This is already recommended by reporting guidelines, such as the CONSORT (Schulz et al., 2010) and APA publication manual (2010). However, it is known that adherence to guidelines is not perfect (Samaan et al., 2013), and our results here demonstrate that this is also the case in the field of company-sponsored studies of traffic safety-related research. The responsibility is on peer reviewers and editors to insure no paper with insufficient information about participant recruitment slips through the peer-review process.

In our view, company researchers should by default avoid utilizing company employees as participants. This especially applies to studies testing company products and in cases with a high possibility of experimenter or good subject effect occurrence (e.g., usability, user satisfaction). If company employees are used as participants, a proper explanation should be provided about why that would be acceptable in a given setting. Possible limitations should also be discussed.

Furthermore, ethical issues, such as the voluntarism of low-power groups, reimbursement, and consent forms, must be considered before data collection and addressed in the article. We hope our paper will contribute to an awareness among researchers, reviewers, and editors about related methodological and ethical implications.

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Appendix.

Scopus search syntax for papers published by car company researchers.

(AFFIL(Audi) OR AFFIL(BMW) OR AFFIL(Chrysler) OR AFFIL(Citroen) OR AFFIL(Dacia) OR AFFIL(Daihatsu) OR AFFIL(Daimler) OR AFFIL(Dodge) OR AFFIL(Ferrari) OR AFFIL(Fiat) OR AFFIL(Ford) OR AFFIL(General motors) OR AFFIL(Honda) OR AFFIL(Hyundai) OR AFFIL(Jaguar) OR AFFIL(Jeep) OR AFFIL(Kia) OR AFFIL(Lada) OR AFFIL(Lamborghini) OR AFFIL(Lancia) OR AFFIL(Land Rover) OR AFFIL(Lexus) OR AFFIL(Mazda) OR AFFIL(Mercedes) OR AFFIL(Nissan) OR AFFIL(Opel) OR AFFIL(Porsche) OR AFFIL(Peugeot) OR AFFIL(Renault) OR AFFIL(Rolls-Royce) OR AFFIL(Saab) OR AFFIL(Škoda) OR AFFIL(Skoda) OR AFFIL(Subaru) OR AFFIL(Suzuki) OR AFFIL(Tata) OR AFFIL(Tesla) OR AFFIL(Toyota) OR AFFIL(Volkswagen) OR AFFIL(Volvo) OR AFFIL(Vauxhall Motors))

AND (PUBYEAR > 2010 AND PUBYEAR < 2016)

AND (LIMIT-TO (EXACTSRCTITLE,"Transportation Research Part F Traffic Psychology And Behaviour ") OR LIMIT-TO (EXACTSRCTITLE,"Accident Analysis And Prevention ") OR LIMIT-TO (EXACTSRCTITLE,"Human Factors ") OR LIMIT-TO (EXACTSRCTITLE,"Injury Prevention ") OR LIMIT-TO (EXACTSRCTITLE," Iet Intelligent Transport Systems ") OR LIMIT-TO (EXACTSRCTITLE," Transportation Research Part C Emerging Technologies ") OR LIMIT-TO (EXACTSRCTITLE," Safety Science ") OR LIMIT-TO (EXACTSRCTITLE," Traffic Injury Prevention ") OR LIMIT-TO (EXACTSRCTITLE," Iatss Research ") OR LIMIT-TO (EXACTSRCTITLE," Ergonomics ") OR LIMIT-TO (EXACTSRCTITLE," Journal Of Safety Research "))

AND (LIMIT-TO (DOCTYPE,"ar") OR LIMIT-TO (DOCTYPE,"cp"))

Publishers of the eleven journals are as follows. **British Medical Journal Publishing Group**: IP; **Elsevier**: AAP ("Affiliated with the Association for the Advancement of Automotive Medicine"), IR ("on behalf of International Association of Traffic and Safety Sciences"), JSR ("A Joint

Publication of the National Safety Council and Elsevier"), SS, TRC, and TRF ("Supported by the International Association of Applied Psychology"); **Institution of Engineering and Technology** (IET); **SAGE Publishing:** HF ("The Journal of the Human Factors and Ergonomics Society"); **Taylor and Francis:** ERG ("The Official Journal of the Chartered Institute of Ergonomics and Human Factors"), and TIP ("the official journal of the Association for the Advancement of Automotive Medicine, the International Council on Alcohol Drugs and Traffic Safety, the International Research Council on the Biomechanics of Impact, and the International Traffic Medicine Association").

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